be impossible, for there are only 375,000 Turks in the province, most of whom reside in the towns in all parts of Bulgaria, while the total population is between four and five millions. Evidently M. Lejean reckoned among his Turks the Mahometan Bulgarians, who reside for the most part in the eastern districts.

The whole of this valuable little pamphlet is contained in seventeen pages, and its usefulness is considerably increased by a good map. The map embraces all the country occupied by the Southern Slavonians, from Galicia to the Ægean Sea, and seems to be very accurate ; but it is a pity that Dr. Petermann did not leave out the shading of the mountains. This, in a map on such a small scale, is totally useless for topographical purposes, and only occupies space which would be much more profitably employed by the insertion of more names of places, besides obscuring the names which already exist. The districts inhabited by Slavonians are painted green, thus showing at a glance their geographical position. It would have been better to distinguish by a different colour the Bulgarians—who, like the Russians, are Slavonians grafted on a Turanian stock, from the pure Slavonians, such as the Servians, Croats, and Ruthenians.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Government Aid to Science

I VENTURE to hope that you will allow me space in your columns to express opinions on this subject which are not popular with scientific men, and which are evidently opposed to your own views as indicated in your recent article on Science Reform.

The public mind seems now to be going mad on the subject of education ; the Government is obliged to give way to the clamour, and men of science seem inclined to seize the opportunity to get, if possible, some share in the public money. Art education is already to a considerable extent supplied by the State,—technical education (which I presume means education in "the arts") is vigorously pressed upon the Government,—and Science also is now urging her claims to a modicum of State patronage and support.

Now, sir, I protest most earnestly against the application of public money to any of the above specified purposes, as radically vicious in principle, and as being in the present state of society a positive wrong. In order to clear the ground let me state that, for the purpose of the present argument, I admit the right and duty of the State to educate its citizens. I uphold national education, but I object absolutely to all sectional or class education ; and all the above-named schemes are simply forms of class education. The broad principle I go upon is this,—that the State has no moral right to apply funds raised by the taxation of all its members to any purpose which is not directly available for the benefit of all. As it has no right to give class preferences in legislation, so it has no right to give class preferences in the expenditure of public money. If we follow this principle, national education is not forbidden, whether given in schools supported by the State, or in museums, or galleries, or gardens, fairly distributed over the whole kingdom, and so regulated as to be equally available for the instruction and amusement of all classes of the community. But here a line must be drawn. The schools, the museums, the galleries, the gardens, must all alike be *popular* (that is, adapted for and capable of being fully used and enjoyed by the people at large), and must be developed by means of public money to such an extent only as is needful for the highest attainable *popular* instruction and benefit. All beyond this should be left to private munificence, to societies, or to the classes benefited, to supply.

In art, all that is needed only for the special instruction of artists, or for the delight of amateurs, should be provided by artists and amateurs. To expend public money on third-rate prints or pictures, or on an intrinsically worthless book, both of immense value on account of their rarity, and as such of great interest to a small class of literary and art amateurs and to them only, I conceive to be absolutely wrong. So, in science, to provide museums such as will at once elevate, instruct, and entertain all who visit them is a worthy and a just expenditure of public money ; but to spend many times as much as is necessary for this purpose in forming enormous collections of all the rarities that can be obtained, however obscure and generally uninteresting they may be, and however limited the class who can value or appreciate them, is, as plainly, an unjust expenditure. It will, perhaps, surprise some of your readers to find a naturalist advocating such doctrines as these ; but though I love nature much I love justice more, and would not wish that any man should be compelled to contribute towards the support of an institution of no interest to the great mass of my countrymen, however interesting to myself.

For the same reason I maintain that all schools of art or of science, or for technical education, should be supported by the parties who are directly interested in them or benefited by them. If designs are not forthcoming for the English manufacturer, and he is thus unable to compete with foreigners, who should provide schools of design but the manufacturers and the pupils who are the parties directly interested ? It seems to me as entirely beyond the proper sphere of the functions of the State to interfere in this matter as it would be to teach English bootmakers or English cooks at the public expense in order that they may be able to compete with French *artistes* in these departments. In both cases such interference amounts to protection and class legislation, and I have yet to learn that these can be justified by the urgent necessity of our producing shawls and calicoes, or hardware and crockery, as elegantly designed as those of our neighbours. And if our men of science want more complete laboratories, or finer telescopes, or more expensive apparatus of any kind, who but our scientific associations and the large and wealthy class now interested in science should supply the want ? They have hitherto done so nobly, and I should myself feel that it was better that the march of scientific discovery should be a little less rapid (and of late years the pace has not been bad), than that Science should descend one step from her lofty independence and sue *in formâ pauperis* to the already overburthened taxpayer. So if our mechanics are not so well able as they might be to improve the various arts they are engaged in, surely the parties who ought to provide them with the special education required are the great employers of labour, who by their assistance are daily building up colossal fortunes ; and that great and wealthy class which is, professionally or otherwise, interested in the constructive or decorative arts.

I maintain further, not only that the money spent by Government for the purposes here indicated is wrongly spent, but also that it is in a great measure money wasted. The best collectors are usually private amateurs, the best workers are usually home students or the employés of scientific associations, not of governments. Could any Government institution have produced results so much superior to those produced by our Royal Institution, with its Davy, Faraday, and Tyndall, as to justify the infringement of a great principle ? Would the grand series of scientific and mechanical inventions of this century have been more thoroughly and more fruitfully worked out, if Government had taken science and invention under its special patronage in the year 1800, and had subjected them to a process of forcing from that day to this ? No one can really believe that we should have got on any better under such a *régime*, while it is certain that much power would have been wasted in the attempt to develop inventions and discoveries before the age was ripe for them, and which would therefore have inevitably languished and been laid aside without producing any great results. Experience shows that public competition ensures a greater supply of the materials and a greater demand for the products of science and art, and is thus a greater stimulus to true and healthy progress than any Government patronage. Let it but become an established rule that all institutions solely for the advancement of science and art must be supported by private munificence, and we may be sure that such institutions would be quite as well supported as they are now, and I believe much better. If they were not, it would only prove more clearly how unjust it is to take money from the public purse to pay for that which science-and-art-amateurs would very much like to have, but are not willing themselves to pay for.

The very common line of argument which attempts to prove the wide-spread uses and high educating influences of art and of science, are utterly beside the question. Every product of the human intellect is more or less valuable ; but it does not therefore follow that it is just to provide any particular product for those who want it, at the expense of those who either do not want, or are

not in a condition to make use of it. Good architecture, for instance, is a very good thing, and one we are much in want of; but it will hardly be maintained that architects should be taught their profession at the public expense. The history of old china, of old clothes, or of postage stamps, are each of great interest to more or less extensive sections of the community, and much may be said in each case to prove the value of the study; but surely no honest representative of the nation could vote, say, the moderate sum of a million sterling for three museums to exhibit these objects, with a full staff of beadles, curators, and professors at an equally moderate expenditure of £10,000 annually, and a like sum for the purchase of specimens. But if we once admit the right of the Government to support institutions for the benefit of any class of students or amateurs however large and respectable, we adopt a principle which will enable us to offer but a feeble resistance to the claims of less and less extensive interests whenever they happen to become the fashion.

If it be asked (as it will be) what we are to do with existing institutions supported by Government, I am at once ready with an answer. Taking the typical examples of the National Gallery and the British Museum, I maintain that these institutions should be reorganised, so as to make them in the highest degree entertaining and instructive to the mass of the people;—that no public money should be spent on the purchase of specimens, but what they already contain should be so thoroughly cared for and utilised as to make these establishments the safest, the best, and the most worthy receptacles for the treasures accumulated by wealthy amateurs and students, who would then be ready to bestow them on the nation to a much greater extent than they do at present. From the duplicates which would thus accumulate in these institutions, the other great centres of population in the kingdom should be proportionately supplied, and from the Metropolitan centres trained officers should be sent to organise and superintend local institutions, such a proportion of their salaries being paid by Government as fairly to equalise the expenditure of public money over the whole kingdom, and thus not infringe that great principle of equality and justice which I maintain should be our guide in all such cases.

This communication will doubtless call forth much opposition, but I trust it will also elicit the support of some of those eminent scientific men, who I know hold similar general views, and who are so much better able than I am to explain and support them.

ALFRED R. WALLACE

Kant's View of Space

IN the very remarkable contribution by Professor Sylvester, (NATURE, No. 9) this sentence occurs: "It is very common, not to say universal, with English writers, even such authorised ones as Whewell, Lewes, or Herbert Spencer, to refer to Kant's doctrine as affirming space to be a 'form of thought' 'or of the understanding.' This is putting into Kant's mouth (as pointed out to me by Dr. C. M. Ingleby) words which he would have been the first to disclaim."

It is not on personal grounds that I wish to rectify the misconception into which Dr. Ingleby has betrayed Professor Sylvester. When objections are made to what I have written, it is my habit either silently to correct my error, or silently to disregard the criticism. In the present case I might be perfectly contented to disregard a criticism which any one who even glanced at my exposition of Kant would see to be altogether inexact; but as misapprehensions of Kant are painfully abundant, readers of Kant being few, and those who take his name in vain being many, it may be worth while to stop *this* error from getting into circulation through the channel of NATURE. Kant assuredly did teach, as Professor Sylvester says, and as I have repeatedly stated, that space is a form of intuition. But there is no discrepancy at all in also saying that he taught space to be a "form of thought," since every student of Kant knows that intuition without thought is mere sensuous *impression*. Kant considered the mind under three aspects, Sensibility, Understanding, and Reason. The *à priori* forms of Sensibility, which rendered Experience possible, were Space and Time: these were forms of thought, conditions of cognition. It was by such forms of thought that he reoccupied the position taken by Leibnitz in defending and amending the doctrine of innate ideas, namely, that knowledge has another source besides sensible experience,—the *intellectus ipse*.

While, therefore, any one who spoke of space as a "form of the understanding" would certainly use language which Kant would have disclaimed, Kant himself would have been surprised to hear that space was not held by him as a "form of thought."

January 3 GEORGE HENRY LEWES

Transcendent Space

As my name has been mentioned by Prof. Sylvester, at p. 238 of NATURE, in connection with this subject, I must ask you to allow me to make a brief remark thereupon. With the late Prof. Donkin I have not the least doubt as to this notion being "only a disguised form of algebraical formulisation." I observe that Prof. Sylvester, while *hypothetically* mentioning his own blindness, backs up his belief by the names of seven great mathematicians, who are *hypothetically* assumed to have "an inner assurance of the reality" of space of four dimensions. A roll-call of great names is no evidence of a strong position, and in the present case the citation is somewhat unfortunate. My old friend Dr. Salmon, who is one of the seven mathematicians cited, would, I am sure, disclaim any such "inner assurance." Without any breach of confidence I may quote his own reply to a question which I put to him long before the delivery of Prof. Sylvester's address. It was in these words: "I do not profess to be able to conceive *affairs* of four dimensions. . . . I advise you to believe whatever Sylvester tells you, for he has the power of seeing things invisible to ordinary mortals."

It would be more satisfactory to unbelievers like myself if the gifted author of the address were to assure the world that he had an insight into, or clear conception of, this transcendent space, According to my own view, *space cannot have more or less than three dimensions;* but if a form of extension having four dimensions were once revealed to us, tridimensional space (in which we now "live and move and have our being," and which is for us one of *two only universal forms of sense*), together with all that it contains, would become zero, and thenceforward we should only be able to conceive tridimensional space as a limit to the finite contents of quadridimensional space. Nay, more, the new space would be inevitably fatal to the law of gravitation, which is a transcendental deduction from the three only dimensions of space. Of course I see plainly enough that the Hamiltonian theory of "quinaries" (which is at present concretely interpretable only in time, *i.e.* as applied to sets of five points in time) might be developed into a rectorial system of *Quinions*, where the four symbols of operation would express the rotation of a straight line about four symmetrical axes; but the form of extension required for the interpretation of such a system is not only inconceivable, but is seemingly opposed to the very intellect itself.

Ilford, January 8 C. M. INGLEBY

The Cyclone

IN answer to the request of your correspondent, F.R.A.S., of Plymouth, in No. 8 of NATURE, I venture to send the following observations of the storm of Dec. 16, in West Suffolk. The barometer is reduced to sea level and 32° Fahr.

Dec. 16—2 p.m.: bar. 29·598, having fallen about ·15 since the morning: air temp. 44° max. of day hours; wind fresh, S., sky overcast.

5 p.m.: bar. 29·334, air temp. 42°; wind S.S.E. high, with heavy rain, which had begun about 4.

10 p.m.: bar. 28·821, a fall of ·5 in 5 hours; wind S.W. gale; rain stopped. The rainfall amounted to ·53 in. During this gale the temp. rose to 54°. The wind veered, at times blowing with great violence, attaining its maximum a little before 11 p.m. Direction nearly W. After 11 the force began to abate.

12 mid.: bar. 29·031, a rise of ·2; wind high from W.N.W.

Dec. 17.—Bar. 29·625, wind still very fresh from W.N.W.

The movement of the barometer from 2 to 10 p.m. of 16th, was 0·78 in., and on morning of 17th the pressure returned to the same point as on 2 p.m. of 16th. The maximum of the wind force occurred a little after the minimum of air pressure, when barometer was rising (compare Capt. Toynbee's "Isobaric Curves" pp. 6, 7). The veering of the wind shows that the track of the centre of the storm passed to the N. of this latitude (52° N.) M.A.

Haverhill, Suffolk, Dec. 28

I ONLY noticed this morning a request of one of your correspondents, who wishes some one in the north or east of England to give an account of the storm which occurred on the 17th instant, as he considers it a remarkable instance of a cyclone.

I enclose the hourly readings of the barograph and anemograph at Stonyhurst during the storm that occurred on the 17th and 19th, but I doubt whether they will be found very confirmatory of the supposed nature of the storm. The fall and rise of the barometer agree remarkably with the complete circuit through which the wind veered from W.S.W. through S. and N. back to W.S.W., but the storm, as is usually the case, began about